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Assessment of Elementary School Children for Disaster-Related Posttraumatic Stress Disorder Symptoms: The Kauai Recovery Index

Children are often affected by natural disasters, particularly community-wide disasters such as floods, earthquakes, and hurricanes. Early investigations (Earls et al., 1988; Hanford et al., 1986) that suggested that children either did not suffer psychological sequelae or postdisaster reactions were short-lived contrast with more recent findings. Investigations of large samples of children and adolescents exposed

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to Hurricanes Hugo and Andrew reveal that as many as 90% report significant posttraumatic stress disorder (PTSD) symptoms (Lonigan et al., 1994; Vernberg et al., 1996) that persist 10 months later in up to 78% of the sample (LaGreca et al., 1996) and 21 months later in a different sample (Shaw et al., 1996). The posttraumatic reactions of reexperiencing, numbing or avoidance, and hyperarousal may detrimentally impact children's functioning in school and in family and peer relationships (Vogel and Vernberg, 1993).

Given the impact of natural disaster, it seems essential to assess PTSD symptoms during the acute postdisaster period and in ensuing months to plan and assess interventions and to monitor recovery. Such assessment requires a reliable and valid instrument that can elicit children's own reports of their adjustment because parents and teachers appear to underestimate the level of postdisaster psychological disturbance experienced by children when compared with children's self-ratings (Belter et al., 1991; Earls et al., 1988). The instrument should inquire specifically about reexperiencing, avoidance, and hyperarousal symptoms, since disaster-exposed children rarely show elevations on general behavior problem checklists (Vogel and Vernberg, 1993), and should be easily administered to large numbers of children. A brief, developmentally sensitive questionnaire that can be administered repeatedly in schools with minimum disruption and burden on teachers is preferable to resource-intensive interviews because of the need to minimize respondent and system burden.

Lonigan et al. (1994; Shannon et al., 1994) and Vernberg et al. (1996; La Greca et al., 1996) reported psychometric analyses of adaptations of the PTSD Reaction Index for Children semistructured interview (RI; Frederick, 1985). Lonigan's group administered a 20-item questionnaire version of the scale 3 months after Hurricane Hugo to 5687 children aged 9 to 19 years who had been exposed to the hurricane. Participants rated the frequency of occurrence of PTSD symptoms along a 5-point Likert scale. Vernberg et al. administered a 3-point rating scale version of this questionnaire 3 months after Hurricane Andrew to 568 third through fifth graders who had been exposed to the hurricane. Both groups found high internal reliability for the RI as a whole (Cronbach's alpha = .83 and .89) and moderate to high internal reliabilities for symptom clusters reflecting reexperiencing (.86 and .75), numbing and avoidance (.55 and .64), and hyperarousal (.57 in both). Children who reported fearing for their lives more or who were victims of more hurricane-related damage scored higher on the RI, supporting the scale's validity. However, neither research group utilized factor analyses to confirm the clustering of symptoms nor did they report test-retest reliabilities. March et al. (1997) surveyed 1019 fourth- to ninth-grade students 9 months after an industrial fire using the Self-Reported Post-Traumatic Symptomatology scale. Among the 30 items on this scale, respondents rated 12 items tapping PTSD symptoms on a 4-point Likert scale. Factor analysis yielded a 3-factor solution reflecting reexperiencing, avoidance, and hyperarousal. The authors reported no reliability data and described validity data for the reexperiencing factor only.

These research programs did not focus primarily on establishing the psychometric properties of a PTSD questionnaire and therefore have some shortcomings in this regard. The current article reports the first and second stage results of a project to establish the psychometric properties of a PTSD symptom scale for children designed to be used community-wide after disasters.

Methods

Study 1: Development of the First-Generation Measure: The Child Reaction Index

Questionnaire Construction. The Child Reaction Index (CRI) was based on items from the child self-report version of Frederick's (1985) RI. Items contained in Frederick's measure were selected and revised by simplifying words to facilitate comprehension by public school children in Hawaii. Two child clinical psychologists and a child psychiatrist derived additional items rationally. Thirty-four CRI items were developed that described three clusters of posttrauma symptoms consistent with DSM-III-R (APA, 1987) criteria for PTSD—reexperiencing, avoidance, and arousal. A few of the items represented age-specific trauma symptoms that did not pertain to the three symptom clusters. Items were rated on a 5-point scale ranging from "no" to "almost all of the time."

Participants. Four hundred fifty-two children in grades 1 through 6 completed the CRI 3 to 4 months after Hurricane Iniki, a category 4 storm, devastated the island of Kauai. All children resided in and were exposed to Hurricane Iniki on Kauai. The sample consisted of 57% boys and 43% girls, with an average age of 8.9 years (SD = 1.77; range, 6 to 12 years). Thirty-three percent of the children were Asian, 22% white, 25% Hawaiian or part-Hawaiian, 7% mixed, and 13% other ethnic backgrounds.

Procedure. Following receipt of parental consent, homeroom teachers in two participating schools administered the CRI to the children. Teachers read each item to their students, and students marked their responses on the questionnaire. Approximately 8% (N = 35) of the children were administered the CRI individually as they had relocated to the island of Oahu.

Study 2: Psychometric Evaluation of the Second-Generation Measure: The Kauai Recovery Index

Questionnaire Revision. Based on Study 1, we revised the CRI by a) eliminating items poorly associated with other CRI items (*i.e.*, item-total $r < .35$) and b) revising item wording to more directly represent DSM-IV (APA, 1994) diagnostic criteria for PTSD and associated age-specific features. We also changed the rating scale to a 3-point scale to make it easier for younger children to respond. Revision yielded the second-generation 24-item Kauai Recovery Index (KRI).

Participants. The participants were 3732 children aged 6 to 15 years (mean = 9.49 years; SD = 1.55) who participated in a screening of Kauai public school children conducted 26 months after Hurricane Iniki. Participants were second (20%), third (20%), fourth (19%), fifth (20%), and sixth (21%)

grade students. Fifty-three percent of the participants were boys. Consistent with Study 1, the sample was ethnically diverse with 38% Asians, 28% Hawaiians or part-Hawaiians, 22% whites, and 12% other ethnic backgrounds.

Measures. The measures included the KRI, six hurricane exposure questions, and three demographic questions. The KRI is a 24-item self-report instrument designed to measure presence of PTSD symptoms and includes three primary clusters of PTSD symptoms: reexperiencing (6 items), avoidance (7 items), and arousal (6 items). Additional items represented age-specific (2 items) and associated features (3 items) that did not pertain to PTSD symptoms. Each item was rated on the following 3-point scale: "no" = 0, "sometimes" = 1, and "almost all the time" = 2. KRI total scale scores range from a minimum of 0 to a maximum of 48.

The six hurricane exposure questions asked a) whether the child lived in Hawaii during Hurricane Iniki, b) where the child was when the hurricane struck Kauai, c) whether the child thought that he or she would die or get hurt, d) whether the child thought a close family member would die or get hurt, e) how much the hurricane hurt the family's home, and f) how scared the child was during the hurricane. Demographic questions included grade, gender, and ethnicity.

Procedure. The measures were group administered to all second through sixth grade public school classes in Kauai by teachers using standardized instructions tailored to grade level comprehension. Consent was obtained through a passive consent procedure that informed parents of the screening and gave them the opportunity to opt their children out of screening. Research oversight of the larger project within which the screening was conducted, including the procedures used to assure protection of human subjects, is described in greater detail in Chemtob et al. (2002).

Results

Reliability of the CRI was evaluated by inspecting internal consistency reliability estimates and item-total score correlations. Internal consistency of all CRI items was relatively high (Cronbach's alpha = .85), but lower reliability estimates were found for the reexperiencing (alpha = .73), avoidance (alpha = .40), and arousal (alpha = .58) symptom subscales.

Descriptive Information. KRI total scores ranged from 0 to 44 (mean = 11.73, SD = 7.38). Scores for girls (mean = 12.71, SD = 7.61) were significantly higher than for boys (mean = 10.85, SD = 7.05), $F(1,3730) = 59.49$, $p < .001$. KRI means differed significantly across grade level, $F(4,3727) = 58.90$, $p < .001$, with second (mean = 13.86, SD = 7.97), third (mean = 13.09, SD = 7.43), and fourth graders (mean = 12.49, SD = 7.46) significantly higher than fifth (mean = 9.88, SD = 6.50) and sixth graders (mean = 9.36, SD = 6.33). KRI means for each ethnic group did not differ significantly.

Reliability. The reliability of the KRI was evaluated by inspecting internal consistency and stability estimates. The KRI demonstrated high internal consistency across all items (Cronbach's alpha = .84). The three rationally derived subscales showed high to moderate internal consistency. Alpha coefficients were .75 for reexperiencing, .52 for avoidance, and .64 for arousal. The KRI was readministered to a subsample of 43 children 4 weeks after the initial assessment. The 4-week test-retest reliability estimate was .77 for this subsample.

Validity. It was hypothesized that KRI scores would increase as children's exposure to the hurricane increased. In support of this hypothesis, we found significantly larger KRI composite scores among children who thought they would "die or get hurt" during the hurricane, $F(1,3722) = 428.41$, $p < .001$; children who feared for the lives of family members, $F(1,3711) = 299.47$, $p < .001$; children whose home suffered greater damage, $F(4,3707) = 10.85$, $p < .001$; and children who reported greater fear during the hurricane $F(4,3693) = 213.52$, $p < .001$, than those who did not.

Exploratory Factor Analysis. Principal axis factor analysis with promax rotation was conducted on the 24 KRI items. A four-factor solution accounting for 38.9% of the variance was selected based on an examination of the scree plot of eigenvalues, Kaiser-Guttman criteria, and theoretical soundness of the factor structures. As shown in Table 1, items corresponding to the three rationally derived subscales defined three of the factors and were labeled reexperiencing (factor 1), arousal (factor 2), and avoidance (factor 3). The fourth factor consisted of two idiosyncratic items.

Discussion

This analysis confirms the psychometric soundness of the KRI. KRI internal reliability was comparable with that reported for versions of the RI in previous studies. Factor analysis resulted in three major factors paralleling the reexperiencing, avoidance, and hyperarousal clusters described by DSM-IV (APA, 1994). The KRI has adequate test-retest reliability. Consistent with research using the RI (Shannon et al., 1994; Vernberg et al., 1996), gender and age differences were present in KRI scores, and the strong relationship between KRI scores and exposure to the hurricane is consistent with prior research, thus supporting validity of the KRI.

Discarding some items may refine the KRI. Candidates for elimination are the two items that loaded on the fourth factor. These items were originally associated with the avoidance and hyperarousal subscales and, in their wording, do not refer to the disaster in any direct or indirect way. It may be that these are useful interview items but are too subtle or indirect when presented in a self-administered questionnaire. We also suggest discarding items with factor loadings less than .40. The brevity of the resulting 19-item scale would be a positive attribute in a postdisaster setting.

There are limitations to this research that bear on ways to further refine the KRI. The data utilized in these analyses were questionnaire data and therefore subject to the shortcomings of information obtained via a single modality. Comparing children's KRI scores with their responses on structured interviews to assess PTSD symptoms would strengthen concurrent validity. Without access to concurrent interviews,

TABLE 1
Factor Pattern Loadings for Four-Factor Solution (N = 3732)

Item	Factor Loading
Factor 1: Intrusion/Re-experiencing	
1. When something reminds you about the hurricane, do you get scared or worried?	.64
2. Do you have bad dreams about the hurricane?	.62
3. Do you think about the hurricane even when you don't want to?	.62
4. Does your heart beat faster when something reminds you about the hurricane?	.58
5. Do you think about the hurricane over and over again?	.51
6. Do you have bad dreams?	.51
7. Nowadays, are there things that happen that make you think a hurricane is going to happen?	.49
8. Do your thoughts and feelings about the hurricane make it hard for you to remember things like what you learned in school?	.49
9. Nowadays, do you feel more scared or nervous than before the hurricane?	.46
10. Do you feel bad because of something you did during the hurricane?	.41
11. Do you feel bad because you didn't do something during the hurricane?	.38
12. Since the hurricane, do you do things that you used to do only when you were little, like suck your thumb, bite your nails, sleep with your parents, or wet your bed?	.33
13. Do you have a hard time remembering what happened during the hurricane?	.22
Factor 2: Arousal	
1. Nowadays, is it hard for you to concentrate or pay attention?	.56
2. Nowadays, do you feel grouchy or mad?	.53
3. Nowadays, do you feel nervous or jumpy?	.52
4. Nowadays, is it hard for you to get along with your friends and family?	.51
5. Nowadays, do you have stomachaches, headaches, or other sick feelings?	.47
Factor 3: Avoidance	
1. Do you try not to think about the hurricane?	.58
2. Do you try not to talk about your feelings about the hurricane?	.56
3. Do you try to stay away from things that remind you about the hurricane?	.55
4. Nowadays, are you extra careful so that bad things don't happen?	.43
Factor 4: Idiosyncratic Items	
1. Do you sleep okay?	.45
2. Do you think you'll have a good life in the future?	.40

no analyses of the KRI's sensitivity or specificity to identify "cases" of mental disorder are possible. Data regarding the scale's sensitivity to changes in level of PTSD symptoms were obtained, however, and are described as part of our treatment study (Chemtob et al., 2002). Finally, we did not endeavor here to develop age and gender norms for the KRI. These data show the KRI to be a reliable and valid instrument that can be used to screen children suffering from postdisaster trauma symptoms in the aftermath of large-scale disasters. The KRI can be readily used as a brief instrument to screen disaster-exposed children in schools to identify those in need of psychological intervention and to plan and monitor effects of those interventions. It can also be used to monitor over time the psychological recovery of children after a disaster.

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Lifetime and Current Prevalence of Mental Disorders Among Homeless Men in Korea

The problem of homelessness appears to be increasing to an epidemic proportion in many industrialized countries (Burt, 1992). Homelessness is a common urban problem in the Asian developing countries as well as in the Western countries. As we know, this study is the first Asian study to examine the mental health of the homeless people.

Subjects and Methods

Sample. The study began in February 1999 and ended in January of 2000. The inclusion criteria for this study were: Korean nationality, over 18 years of age, and history of sleeping more than 50% of the time in one or more locations such as the street, abandoned houses, parks, or other places unfit for human habitation (*e.g.*, subways or tunnels) between the dates of becoming homeless and admission to the homeless shelter. When this study began, Seoul had seven public homeless shelters of varying sizes, and we chose the largest facility with 1050 residents. Using a random cluster sampling methods based on the resident roster, 245 residents were asked to participate in our study. Concurrently, Pusan had two public homeless shelters, and we asked all of the 237 residents in both shelters for participation. Altogether, 472 homeless men agreed to participate in our study.

Instruments. The translated Korean version of the Structured Clinical Interview for DSM-IV axis I disorder (SCID-RV) (First et al., 1996) was used. Our group had previously translated the SCID-RV in Korean and established the inter-rater reliability (Han et al., 2000). We used the following modules of the SCID-RV pertaining to the major psychiatric disorder: overview, module A of mood episode, module B of psychotic and associated symptoms, module C of psychotic differential, module D of mood disorder, and module E of substance use disorder. Current and lifetime diagnosis of major axis I diagnosis was based on the DSM IV and SCID-RV algorithms.